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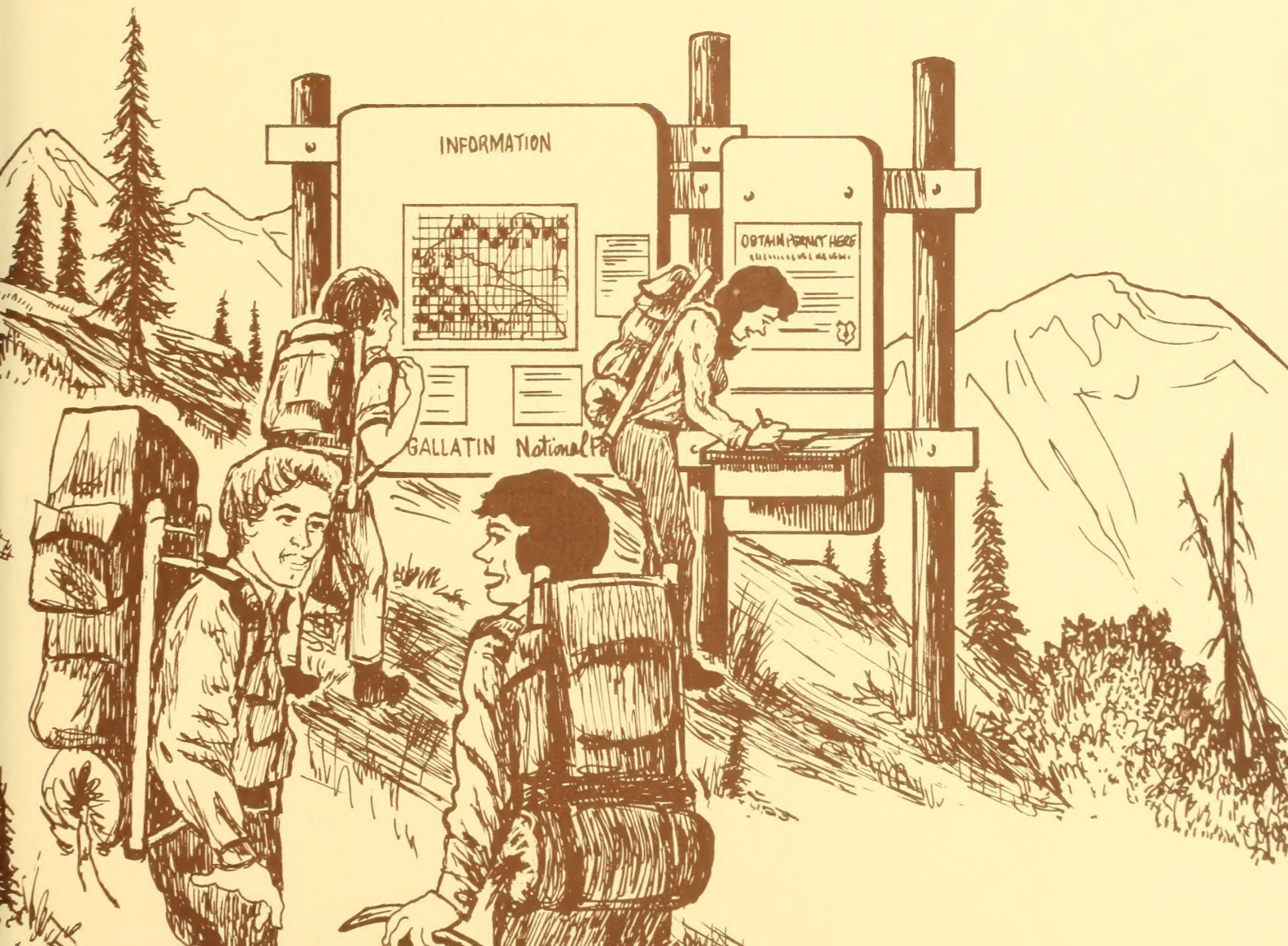
**Intermountain
Forest and Range
Experiment Station**

Research Paper
INT-270

April 1981

Self-Issued Wilderness Permits as a Use Measurement System

Robert C. Lucas and Thomas J. Kovalicky



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RESEARCH SUMMARY

Wilderness recreational use is difficult to measure. Many approaches have been tried, but all have limitations. Self-issued, mandatory permits are a relatively new system. Such a system was begun for the Spanish Peaks Primitive Area, Montana, in 1978. A rigorous evaluation was conducted to determine compliance by different types of visitors and for different types of permit station locations.

Virtually all use at the six major trailheads was counted and classified in terms of compliance and in terms of a number of variables believed to influence visitor compliance, using automatic electronic use-monitoring equipment.

Overall, 53 percent of the visitor groups obtained permits. Compliance varied widely among different trailheads, from 21 to 72 percent. Stations located up the trails away from the parking areas at the trailheads had higher compliance rates than those at the trailheads. Summer and fall compliance rates were identical. Compliance dropped sharply as visits became shorter. This was the factor most strongly related to compliance among the variables examined. Campers, whether hiking or riding, complied 72 percent of the time, and this varied little among trailheads. Day-users had only a 45-percent compliance rate, with wide fluctuations among trailheads. The briefer the day-use, the lower the compliance. Visitors staying less than 2 hours had only a 20-percent compliance rate, while those staying over 3 hours had a 65-percent compliance rate. Day-visitors riding horses had only a 25-percent compliance rate. Persons visiting the area alone had lower compliance than groups.

The self-issued permit system works best for the longer-term visitors, who have the most importance for management planning. The system appears, in its first year, to have produced slightly better data than voluntary trail registers used earlier. It approximates the performance of agency-issued permits in some areas, but falls short of the compliance obtained in other areas. The system appears to have promise as a use measurement system, although a decision to adopt self-issued permits also needs to consider other management objectives, as well as costs of all potential systems. Station location, design, maintenance, and compliance monitoring all need to be emphasized by managers to raise compliance rates and make a self-issuing permit system a useful management tool.

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INTRODUCTION

Wilderness management requires reasonably accurate basic data on recreational use. Most wilderness values result from recreation use and so do most threats to the preservation of wilderness values. As a result, most wilderness management involves managing visitor use (Hendee and others 1978). This requires reliable data, including information about how much use occurs at different places within a wilderness, what type of use it is (methods of travel, party size, lengths of stay, and perhaps types of activities engaged in), and when it occurs.

Planning to modify use, to alter trail systems, or to add or close campsites; estimation of ecological impacts; scheduling public contact specialists; and so on, all depend on use data. Evaluating the success of management efforts in meeting objectives also requires reasonably accurate use data.

With some exceptions, wilderness recreational use data are low in accuracy. Methods that yield reasonably accurate data at acceptable cost are needed, both for management and to provide basic data for research on ecological impacts, crowding perceptions, use distributions, and trends over time. Better use measurement was one of the research needs listed most often by respondents in a recent survey of wilderness managers in all agencies (Washburne in press).

Use Measurement Methods

Wilderness use is one of the most difficult types of recreational use to measure. The typical wilderness has many access points, usually distant from Ranger Stations and difficult to check. Compared to developed sites, use is light and variable (wilderness recreation is, by definition, low density). This makes it prohibitively expensive to observe all entry points--some would have no use at all on certain days. Use is so widely dispersed that it is nearly impossible to make a direct head count, as could be done in developed auto-access campgrounds. Therefore, a variety of indirect ways of measuring wilderness use have been devised: sample observations, electronic counters, automatic cameras, estimates based on data from trail registers or mandatory permits, or guessing, based on informal, unsystematic observations.[1]

A survey of wilderness managers (Washburne in press) shows informal observation is the most common measurement technique (37 percent of all wilderness). Permits are almost as common (36 percent). The remainder (27 percent) use trail registers, and about half of these do some checking to calibrate or relate register data to actual use.

Observing a sample of trailheads on sample days produces accurate estimates (Lucas and others 1971; Lucas and Oltman 1971), but the highly variable use makes reliable sampling difficult and costly. Observers must sit near trails in all kinds of weather, often with long periods in which there is no use to observe.

In addition to entry point sampling, traffic has been sampled at checkpoints on access roads (Lucas 1964). In many areas, one road serves several entry points and results in more use being sampled for the same effort than sampling at trailheads.

Automatic electronic trail traffic counters have been tried with varying success (Lucas and others 1971; James and Schreuder 1972). An improved model that projects an invisible infrared beam onto a reflector and registers a count when the beam is interrupted has been developed and tested successfully (Tietz 1973). (We used these counters in this study, and they worked well.) At best, however, the counters can indicate the number of large, moving objects passing since the last time the counter was read. The counters cannot indicate whether the objects were hikers, packhorses, elk, or cows; when they passed; or how they clustered into parties. There are counters that print out counts and times, but they are expensive. Length of stay or information about activities cannot be obtained from the counters. Neither can direction (entry or exit) or route of travel.

Automatic movie cameras, set to expose one frame at preset intervals, say every 30 seconds, have been used by the National Park Service (Marnell 1977) to estimate use of several wild rivers. Other recording systems employ a movie camera to film a few frames when triggered by a passing object that interrupts an infrared beam. In either case, group size and type of boat usually can be determined. To protect privacy, individuals are not identified, and only public areas through which visitors pass are filmed, not campsites or swimming areas. Such systems appear to have the potential for accurate use measurement, but are probably too expensive for routine, annual use at all entry points to typical wilderness areas with many entry points. Cameras avoid problems of discomfort caused by weather and boredom that afflict human observers, and they are much cheaper.

Many estimates of wilderness use are based on voluntary self-registration at trail registers. Trail registers provide much more complete information than traffic counters. Party size, method of travel, date of entry, length of stay, some data on destination (or itinerary) and activities, and visitor residence are usually obtained. The problem, of course, is that some visitors do not register (Lucas 1975; Lucas and others 1971; Wenger and Gregersen 1964). Some kinds of visitors--especially horsemen, hunters, people making very short visits, and lone individuals--are less likely to register than others. Thus, the resulting registration data not only underestimate use, but also provide biased estimates of its composition.

Efforts have been made to develop systems for basing estimates on voluntary trail register data (James and Schreuder 1971; Lucas and others 1971). In effect, adjustment factors are applied to raw data from the trail register cards to compensate for nonregistration. A sample of registration behavior is observed to develop the adjustment factors.

[1]More than a dozen studies of use estimation for wilderness and dispersed recreation are reviewed by George A. James (1971).

It appears (Lucas 1975) that voluntary trail registration rates may be highly variable from wilderness to wilderness and perhaps over time. This makes it essential to carefully check registration rates before using them as a basis for use estimates. Using observers for field-checking registration is difficult and expensive, however, and is rarely done. Electronic traffic counters, or better, automatic cameras, are useful and less costly sources of information on true total use to compare to registration data. Checking would probably only need to be done at intervals of a number of years, reducing costs. Currently, use estimates based on trail registers have a large, but usually unknown, margin of error.

The most accurate wilderness use data come from mandatory visitor-permit systems (Hendee and Lucas 1973; Washburne in press). Most National Park Wildernesses and more than one-third of all National Forest wildernesses[2] require visitors to obtain permits, a practice also common in Canadian wilderness-type areas. Often, especially in National Parks, only campers must obtain permits; day-users are exempted. In almost all cases, permits must be obtained from the managing agency. In a very few wildernesses, permits are issued by cooperators, such as employees of nearby resorts. Permits provide all of the information obtained from trail registers, in addition to greater detail on planned routes of travel. Some visitors fail to get permits even though they are mandatory (Lime and Lorence 1974), just as some visitors do not register at trail registers. Compliance varies, although it is usually higher than for trail registers.

The agency-issued permit has its disadvantages. The costs of an agency-issued permit system are substantial, primarily for additional employees to issue permits. Obtaining a permit sometimes inconveniences visitors, who usually must visit an agency office, which is often out-of-the-way, during the hours it is open, which may require changes in travel schedules. In some places, permit applications can be made by mail or telephone and permits received by mail, or, when time is short, picked up outside offices after hours.

Managers of several National Forest wildernesses in Washington and Oregon have instituted a system in which visitors issue themselves mandatory permits at trailheads. This system, of course, is only used where use is not rationed. The visitors keep one copy of the permit, which may be checked for compliance by wilderness rangers in the area, and deposit a copy at the trailhead. Informal spot checks suggest that the system may result in higher compliance rates and more accurate data requiring less adjustment than either agency-issued permits or trail registers.

A fourth alternative would be mandatory self-registration. In addition to the copy of the registration form deposited at the registration station, a copy could be carried into the wilderness by the party, making compliance checking possible. Where data collection is the objective, and use control is not planned soon, this might be a more appropriate approach than a permit system which implies the potential for denial of a permit (Sprague 1979). However, to our knowledge such a system has not been used. It is questionable whether Federal agencies could use such an approach. By regulation, the Office of Management and Budget (OMB) must approve collection of information from the public by Federal agencies. There is legal authority for mandatory permits, and OMB approval has been obtained for voluntary trail registration systems, but Forest Service officials believe approval of mandatory registration might be difficult or impossible to obtain (personal communication from Roy Feuchter).

National Forest managers in Montana began using self-issued, mandatory permits in the Spanish Peaks Primitive Area, Gallatin National Forest, on July 1, 1978. This provided an opportunity to evaluate self-issued permits as a use measurement system in a rigorous way.

STUDY OBJECTIVES

The objective of the study was to determine how well a self-issued permit system measured recreational use. Strictly speaking, the study sought to determine the completeness of the use information supplied by visitors. This was **intended use** information because it was supplied before the visit. This study did not seek to determine how **actual** use deviated from **intended** use. It also did not concern itself with accuracy of such information as reported party size.

The study was intended to develop the following specific information:

1. What proportion of parties, classified on the basis of the characteristics below, obtain permits:
   a. Summer/fall visitor groups
   b. Day user/overnight camper groups
   c. Hikers/horseback riders
   d. Party size (single individuals/small parties/large parties.
2. How does permit station location affect compliance behavior by different types of visitors?

[2]A survey of managers (Washburne in press) indicated about 35 percent of all National Forest Wildernesses based use estimates on permits in 1978.

Figure 1.--Double-panel trailhead information center used at major trailheads.

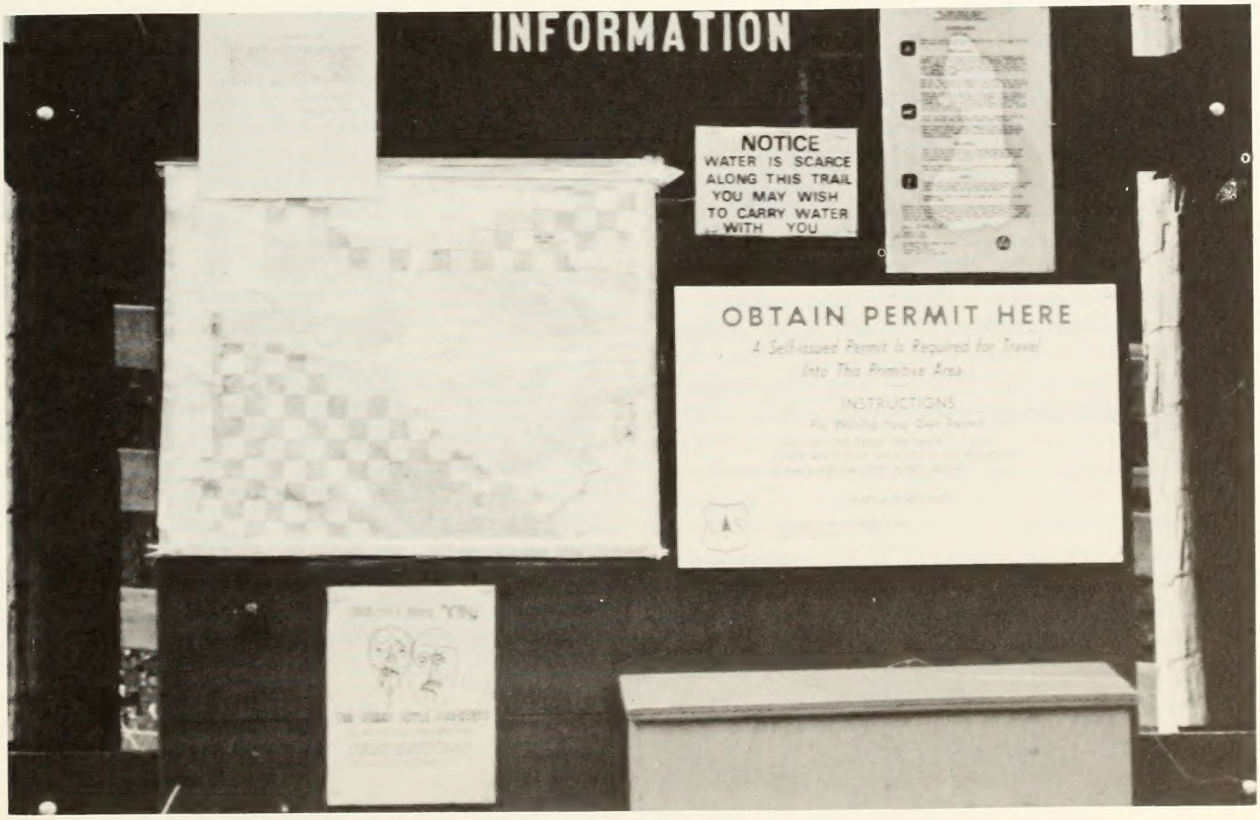

Figure 2.--Single-panel information center used at minor trailheads.

STUDY PROCEDURES

Self-Issued Permit System

Trailhead "information centers" incorporating the self-issuing permit facility were installed at all 11 trail entry points to the Spanish Peaks Primitive Area by the Gallatin/Bozeman Ranger District, Gallatin National Forest, before July 1, 1978. The information centers followed a new standard design for the Northern Region of the Forest Service, consisting of two sign panels at major entries and one sign panel at less-used trailheads (fig. 1 and 2). Standard Forest Service permit forms were used (appendix 1).

The Gallatin/Bozeman Ranger District, the Gallatin National Forest, and Northern Region headquarters informed the public about the new system, its purpose, and desired visitor behavior through press releases to local newspapers and personal contacts with key persons.

Sample Sites

In cooperation with the district ranger and his staff, the following six trailheads, shown in figure 3, were chosen for monitoring use and permit compliance:

1. Spanish Creek
2. Little Hellroaring Creek
3. Hellroaring Creek
4. Cascade Creek (Lava Lake)
5. Deer Creek
6. Hammond Creek

These were the most-used trailheads. Other access points received only very light use.

Observation Period

Sample sites were monitored from July 1, 1978, into the fall as long as possible. Observations ended at different trailheads from November 1 to November 8.

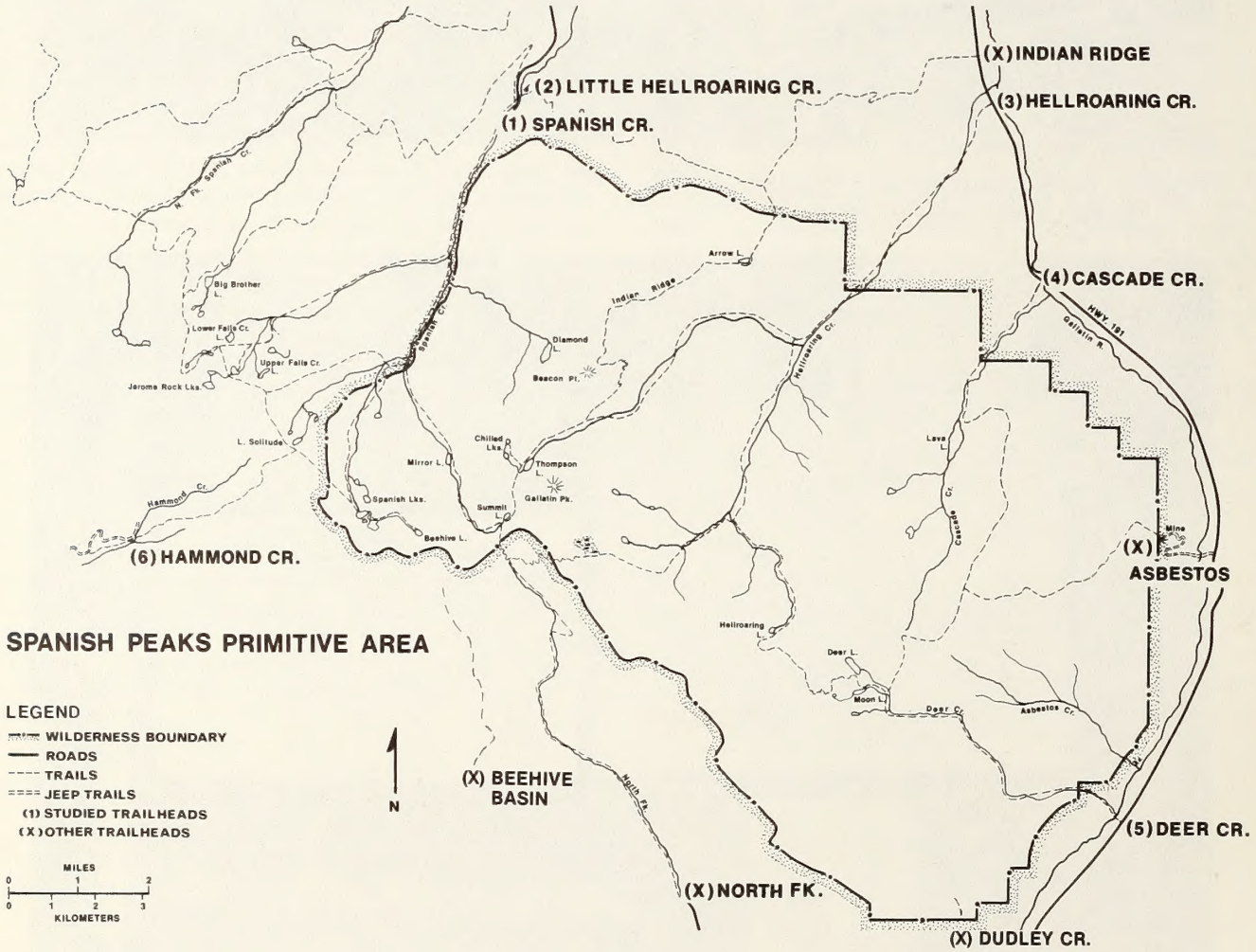

Figure 3.--System of trails and trailheads in the Spanish Peaks Primitive Area.

Observation Methods

Modified movie cameras (fig. 4) triggered by infrared trail traffic counters (fig. 5) were used to measure and classify recreational use. Wherever possible, the cameras were focused on the permit-issuing facility to observe compliance/noncompliance directly. Both camera and counters were camouflaged as well as possible. At one location (Spanish Creek), this was impossible because of the exposed location of the information center sign. In this case, the camera was placed farther along the trail to record all visitor use, which was compared to use accounted for by completed permits.

Figure 4.--Camera used to record trail traffic, mounted in a weatherproof box.

Figure 5.--Trail traffic counter used to activate the camera system.

The camera-counter systems were fabricated by the Forest Service's Missoula Equipment Development Center.[3] A prototype was tested at Spanish Creek in July and August 1977 and performed perfectly. The cameras could be adjusted to run for a variable time per triggering by the traffic counter (up to 252 seconds) and to expose frames at a selected interval (every 2 to 30 seconds). The current model also automatically exposed one frame per hour (24 hours per day) while turning on an internal red light to provide an indication of date and passage of time.

Parties were recorded both entering and leaving; the timing frames helped estimate approximate lengths of stay for day-users. For example, if one red dot separated entrance and exit, the party could only have been up the trail less than 2 hours. It was possible to identify very brief visits and provide additional confirmation of day-use/camper classifications that were based on the presence/absence of large packs or packstock.

Duration and spacing of exposures were set to insure enough information to record the entire party and determine if they obtained a permit (except where the camera was not focused on the information center), while using film at a rate that would not exhaust the film before the next servicing visit.

[3]Information on the camera-counter system is available from the Equipment Development Center (Gasvoda 1978)

In all cases, film exposure intervals were set less than the time a person could move across the camera's field of view. A fast walker or a horse might go about 5 feet per second. If the field of view was 50 feet, this would require about 10 seconds. An exposure interval of 6 or 7 seconds provides some margin of error, and enough overlap to positively record the party composition. We used intervals from 4 to 10 seconds at the various locations where the permit station was in the camera's view.

Where the camera was focused on the permit station, 120 to 180 seconds from beginning to ending filming indicated clearly if the party complied, even if they had not always finished writing and depositing the permit when the camera shut off.

The movie camera used color, super-8 film cassettes that provided about 3,500 frames. Usually, each party triggered the camera twice (in and out). A party with several members retriggered the camera and exposed more film. (The camera initiated a new cycle for each triggering impulse). Thus, film consumption is somewhat greater than twice the number of frames selected for exposure per party, times the number of parties.

Heavily used Spanish Creek and Cascade Creek were visited for servicing at least twice a week and all other sampling locations at least once a week. If there was any chance that the film could be exhausted before the next visit, it was removed, labeled, and sent in for developing. When new film was installed, a few frames were exposed to photograph a card marked with the location and date.

Triggering the camera when persons passed was far superior to simple time lapse photography. With 10-second exposure intervals, film would be exhausted in about 10 hours and very few exposures would include visitors.

Film was viewed as soon as possible to identify any field equipment problems that might need to be corrected.

Protection of Privacy

Both the letter and spirit of privacy laws were fully observed. Forest Service legal counsel has advised that automatic cameras are legal for use as traffic measuring and classifying devices.

Cameras were located and focused so individuals could not be identified. (The pilot test in 1977 showed that individuals were indistinguishable. The two persons who installed the camera and then walked the trail could only distinguish themselves by clothing colors.) Film was kept secured by the field technician and was viewed only by her or authorized officials. After all data were recorded, the film was kept locked securely for 3 months for possible rechecking, and then it was all destroyed. Film was intended to be used only to record use, and this was what the public was told. Therefore, it was decided that it would not have been available for use as evidence in any proceedings against violators, if such a situation developed. (It did not.)

A press release to inform the public of the use of cameras was issued by Gallatin National Forest officers. The press release stated that cameras would be used to measure use, but did not indicate that they were focused on the permit stations. This, together with limited readership of the press release, should have avoided influencing visitors' permit issuance behavior.

Traffic Classification, Permit Compliance

A form was used to record observations from film (appendix 2). Method of travel (horseback riders, hikers, and hikers with packstock) was easily observed. Day-users and campers were classified primarily by noting whether people had large backpacks or packhorses. Day-users were classified by approximate length of stay, using the hourly marked exposures. Group size was classified as well as possible, but, in a few cases, parties were strung out and it was not possible to determine positively who was with whom. We attempted to identify hunters by rifles, but photo quality made this impossible in many cases.

If persons remained at the permit station, apparently filling out forms, and they were still doing so when the camera shut off, it was assumed that they had complied.

Permit Tabulation

Permits were collected whenever the field assistant visited a trailhead. The trailhead name was marked on all of the completed permits. Permits were kept in sequence to aid in estimating dates for any that lacked date of entry.

Permits were compared to the projected film to confirm compliance or noncompliance. For Spanish Creek, this was necessary to make the compliance classifications. At other locations, if parties entered in darkness (especially common in the fall), it was sometimes possible to reconstruct events with the use of permits if such parties exited during daylight hours, so they could be classified in terms of method of travel, party size, and so forth.

Permit Station Location

All permit stations were classified as "end-of-road" or "up-the-trail" (if out of sight of the parking area) for analysis of the effect of location.

ANALYSIS PROCEDURES

Variables Analyzed

Results are primarily descriptive and comparative. Tabulations were made for permit compliance related to the following single variables believed to influence visitor responses:

1. Trailheads
2. Summer/fall
3. Day-users/campers
4. Hikers/hikers with stock/horseback riders
5. Party size: classified as 1 person, 2 through 6 persons, 7 or more persons.

Tabulations for combinations of variables included the following (only one of which is reported here):

1. Summer/fall
   a. Day-use/camper
      (1) Hikers/hikers with stock/horseback riders
      (2) Party size
   b. Hikers/hikers with stock/horseback riders
   c. Party size
2. Hikers/hikers with stock/horseback riders
   a. Party size

Statistical Significance

The data constitute a complete census, not a sample. Thus, "statistical significance" has no meaning. In a sense, **any** difference is significant. The question is not how much statistical confidence can be placed on estimated compliance rates or on differences among them, but, rather, whether or not differences are large enough to be important, and if compliance rates are acceptable.

Evaluation Criteria

Acceptability of visitor compliance with the permit system is a management decision, which needs to take into account costs of the system over time, expected future improvement or deteriorations of visitor compliance, contributions to other objectives, and so forth.

One important consideration is the increase in compliance for this system compared to voluntary self-registration. Reported self-registration rates vary from 28 to 74 percent (Lucas 1975). In the pilot test of equipment at Spanish Creek in August 1977, exactly 50 percent of 130 parties observed registered. Rates varied from 78 percent of overnight hikers (50 parties) to 0 percent of day-use horseback riders (16 parties). Day-hikers registered in 40 percent of the cases, campers using horses in 43 percent of the cases.

The permit system would be considered successful in gathering basic use data, and superior to self-registration, if compliance rates equaled or exceeded 75 percent overall and at least 60 percent at each trailhead.

The less that the major types of uses vary in compliance, the more feasible it will be to base total use estimates on an expansion of permit data. A simple ratio expansion factor seems as accurate as more complex approaches based on regression formulas (Lucas and others 1971), but if compliance rates for common types of visitors vary to an important extent, it would be necessary to classify permits, and apply separate expansion factors to each to accurately estimate the composition of use, as suggested by Lime and Lorence (1974). This makes the procedure more cumbersome for managers, and therefore, this factor is of particular interest in the analysis.

RESULTS

Equipment Performance

The traffic counters and camera systems worked almost perfectly. A few days' observations were lost when one battery failed, but there were no other problems. False triggering of traffic counters, which exposes film with no visitors present, was a minor problem at only one location.

Vandalism was not a significant problem. One camera was discovered with the wires disconnected, but no damage was done. If such recreational use measuring systems are used in the future, brief explanatory cards on the cameras and traffic counters seem desirable to avoid puzzling visitors as to the nature and purpose of the equipment. This suggestion was also made by Leatherberry and Lime (1980) who used the same equipment to monitor a trail register in the upper peninsula of Michigan.

There were no complaints or adverse reaction to the camera system, despite a press release about the study carried by local news papers.

Compliance and Related Factors

1. **Overall.**--In 1978, 53 percent of the visitor groups to the Spanish Peaks issued themselves a permit. This fell short of the desired level (about 75 percent was hoped for) but should be judged in perspective. This was the first year of a new program. It went into effect on July 1, during the use season. It was a new system for Montana, one with which few visitors were familiar. One unusual location, discussed below, pulled the overall compliance rate down 2 percent.

2. **By trailheads.**--Compliance rates varied widely among trailheads (table 1). Cascade Creek was the highest (72 percent) and Hammond Creek the lowest (only 21 percent).

Table 1.--**Compliance by trailhead**

Trailhead	Number of parties entering[1]	Number of parties complying	Percentage complying
Spanish Creek	751	325	43
Little Hellroaring Creek	60	37	62
Hellroaring Creek	111	44	40
Cascade Creek	516	370	72
Deer Creek	142	94	66
Hammond Creek	94	20	21
Total	1,674	890	53

[1]Number of parties observed visiting the area (counted once, although they may have been observed entering and leaving).

Hammond Creek was a special case. The permit station was located about 3 miles from the Primitive Area boundary. Several trails from this trailhead did not lead to the Primitive Area. Many of the visitors did not enter the Primitive Area and thus did not require a permit. Many of them were on horseback rides for the day, while staying at a nearby dude ranch. Because the dude ranch was already covered by a special use permit from the Forest Service, the likelihood of the guides filling out another permit was probably low, regardless of the planned route.

The permit stations located some distance up the trail (Little Hellroaring, Cascade, and Deer Creeks, and Spanish Creek during the fall only, after the station there was moved at the end of summer) performed better, with 64 percent of the visitors obtaining permits there compared to 38 percent at the permit stations located at the trailhead near the road. If Hammond Creek is omitted, the comparison changes little, becoming 64 versus 41 percent. With the exception of Spanish Creek in the fall, all of the stations located up the trail met the desired level of at least 60 percent compliance at each location.

3. **By seasons**.--Summer and fall compliance rates were identical--both 53 percent (table 2). This was unexpected because previous studies (Wenger and Gregersen 1964; Lucas and others 1971) showed substantial drops in the fall, especially for hunters, who were common in the Spanish Peaks.

With the main exception of Deer Creek, fall and summer rates were substantially the same at each trailhead. Deer Creek, with considerable fall day-use, much of it by hunters who had poor compliance, dropped from 78 to 50 percent.

Spanish Creek improved 6 percent, probably related to the move of the information center and permit-issuing facility from the edge of a large, somewhat confusing parking lot up the trail about 100 yards.

4. **By length of stay**.--Compliance dropped sharply as visits became shorter (table 3). Overall, 72 percent of the campers (overnight visitors, whether hiking or using horses) obtained permits, compared to 45 percent of day-users. Campers complied at similar rates (68 to 79 percent) at all trailheads, but day-user compliance rates varied widely among locations (10 to 70 percent, or omitting Hammond Creek, 28 to 70 percent).

Again, the stations located up the trail performed best. The three locations with the highest compliance for campers were all up the trail. After the Spanish Creek station was moved up the trail, compliance by campers jumped from 63 to 81 percent. Day-users complied much better at up-trail locations (55 to 70 percent compliance except at Spanish Creek in the fall, which was only 33 percent) compared to 10 to 28 percent at roadside locations (26 percent for Spanish Creek in the summer).

Compliance for day-users also dropped as stays became more brief. Parties could be classified into approximate lengths of stay in most cases by noting the number of hourly red frames between their entrance and exit. If no red frame separated entrance and exit, their stay could not have exceeded one hour, for example.

The day visitors making longer stays, more than 3 hours, complied almost as well as campers, 65 percent compared to 72 percent for campers. Visitors staying 2 hours or less complied very poorly (20 percent or less compliance). Compliance of day-users was as follows:

Duration of stay	**Compliance**
Hours	Percent
1	17
1-2	20
2-3	43
3+	65

5. **By method of travel**.--There were substantial differences in compliance rates by visitors traveling different ways (table 4). Horseback riders' compliance was lowest (35 percent, or omitting Hammond Creek, 43 percent). The small sample of hikers leading packhorses--only 19 parties--complied best (84 percent). Hikers were intermediate (55 percent).

As related to compliance, method of travel and length of stay are strongly interrelated. (These data will be presented in a subsequent section).

6. **By party size**.--Single persons complied less frequently than larger parties (table 5), obtaining permits only 41 pecent of the time. Medium and large parties had about the same compliance rates (57 and 60 percent, respectively).

7. **Combined factors**.--Compliance was tabulated against combined variables. Table 6 presents the most meaningful of these, showing for each trailhead the compliance rate during summer and fall for day-visitors and campers, separated into hikers and horseback riders. Several relationships stand out:

a. Compliance by campers, both hikers and horse users, is relatively good almost everywhere (about 70 percent, overall), summer and fall.

The occasional lower compliance figures for campers in table 6 are, with one possible exception, all based on light use and few observations. Almost all of these anomalies are based on three or fewer observations. The 20 percent figure for Deer Creek horse campers in the fall is based on observations of only 5 parties. The one possibly significant exception is for fall hiking campers (in other words, backpackers) at Hellroaring Creek, where only 42 percent of 12 parties issued themselves permits. Except for this one situation, backpacker rates ranged, by season, from 63 to 80 percent. Horse campers, omitting values based on small numbers of observations, ranged by season, from 75 to 100 percent, and for the total use period, from 60 to 81 percent.

b. Camper compliance rates for hikers were better at up-trail locations (Little Hellroaring, Cascade, and Deer Creek and Spanish Creek in the fall) than roadside locations, but there was no clear difference for horse campers.

Table 2. -- **Compliance during summer and fall, by trailhead, percentage of total**

Trailhead	Season			
	Summer[1]		Fall[2]	
	Number of parties	Percent complying	Number of parties	Percent complying
Spanish Creek[3]	494	41	257	47
Little Hellroaring Creek	10	60	50	62
Hellroaring Creek	48	42	63	38
Cascade Creek	326	73	190	69
Deer Creek	82	78	60	50
Hammond Creek	78	21	16	25
Total	1,038	53	636	53

[1]July and August.
[2]September, October, November.
[3]The Spanish Creek information center-permit facility was moved from the parking area up the trail, just out of sight of the parking lot, on September 1, 1978.

Table 3. -- **Compliance by length of stay, by trailhead, percentage of total**

Trailhead	Length of stay			
	Day-users		Campers (overnight visitors)	
	Number of parties	Percent complying	Number of parties	Percent complying
Spanish Creek	473	29	278	68
Little Hellroaring Creek	45	58	15	73
Hellroaring Creek	78	28	33	67
Cascade Creek	401	70	115	79
Deer Creek	75	55	67	79
Hammond Creek	77	10	17	71
Total	1,149	45	525	72

Table 4.--**Compliance by method of travel, by trailhead, percentage of total**

Trailhead	Method of travel					
	Hikers		Hikers with stock		Horseback riders	
	Number of parties	Percent complying	Number of parties	Percent complying	Number of parties	Percent complying
Spanish Creek	664	44	6	67	81	37
Little Hellroaring Creek	43	72	1	100	16	31
Hellroaring Creek	93	35	3	100	15	53
Cascade Creek	503	72	3	67	10	40
Deer Creek	108	65	6	100	28	64
Hammond Creek	42	36	--	--	49	8
Total	1,453	55	19	84	199	35

Table 5.--**Compliance by party size, by trailhead, percentage of total**

	Party size, number of persons					
	1		2-6		7 or more	
	Number of parties	Percent complying	Number of parties	Percent complying	Number of parties	Percent complying
Spanish Creek	153	36	574	45	22	55
Little Hellroaring Creek	20	80	38	50	2	0
Hellroaring Creek	42	17	67	55	1	0
Cascade Creek	91	54	410	76	15	93
Deer Creek	42	45	101	76	3	67
Hammond Creek	22	14	63	24	9	11
Total	370	41	1,253	57	52	60

Table 6.--**Compliance by method of travel, length of stay, and season combined, by trailheads, percent of total**

		Method of travel[1]			
		Hikers		Horseback riders	
Trailhead	Season	Day	Campers	Day	Campers
Spanish Creek	Summer	26	63	23	75
	Fall	33	81	33	88
	Total	29	67	26	81
Little Hellroaring Creek	Summer	100*	100	0*	0*
	Fall	70	63	36	100
	Total	71	75	29	50*
Hellroaring Creek	Summer	23	83	50	0*
	Fall	28	42	40	80
	Total	26	63	44	67
Cascade Creek	Summer	72	78	0*	100*
	Fall	67	84	50	50*
	Total	70	80	29	67*
Deer Creek	Summer	66	82	91	100
	Fall	27	78	29	20
	Total	51	80	67	60
Hammond Creek	Summer	25	64	3	100*
	Fall	0	100*	0	67*
	Total	21	69	2	75
Total		51	72	25	70

[1]19 parties hiking with packstock are omitted from this table.
*Based on 3 or fewer observations.

c. Day-hikers complied fairly well at most station locations up the trail.

Spanish Creek in the fall (after the station was moved) was still only 33 percent, and Deer Creek in the fall was only 27 percent. The other day-hikers' compliance rates for up-the-trail locations were all at least 66 percent.

d. Day-hikers complied very poorly at roadside locations. Compliance never reached even 30 percent in such cases.

e. Day horseback riders' compliance rates varied widely, but generally were very low (25 percent overall). Only at Deer Creek (almost three-fourths mile up the trail), did day horseback riders comply fairly well (67 percent).

DISCUSSION AND CONCLUSIONS

The self-issued mandatory permit system worked best as a use measurement system for those types of visitors that most people would consider most critical for wilderness management decisions--the campers and longer-term day-users. The system measured short-term day users poorly. Although, ideally, managers would like complete counts of all types of visitors, if weaknesses exist, the short-term day-users are the least critical group because of their relatively smaller impact on the area and on other visitors. Use by day-use horseback riders, even for long visits, was not well measured, and this probably is a more serious problem because of the greater potential impacts by horses.

Self-Issued Permits Compared to Trail Registers

The self-issued permit system probably provides data that are better than voluntary self-registration. No direct comparison is possible, but table 7 presents available data on registration rates at trail registers, which can be compared generally to data in table 6 and earlier tables.

A test in Michigan, which alternated mandatory registration (using permit forms) and voluntary registration over 2 years at the same trail, found identical 67 percent compliance rates for both systems (Leatherberry and Lime 1980).

Table 7.--**Some reported registration rates for voluntary trail registers**

Areas	State	Year	Source	Visitor type	Registration rate
					Percent
1. Three Sisters Wilderness	Oregon	1961-62	Wenger and Gregersen 1964	Hikers	79
Mountain Lakes Wilderness				Riders	40
				Total	74
2. Mission Mountains	Montana	1968	Lucas, Schreuder,	Summer	74
Primitive Area			and James 1971	Fall	41
				Hikers	66
				Horsemen	44
				Day-use	63
				Campers	74
				Total	65
3. Banff National Park	Alberta	1968	Thorsell 1968	Total	35
4. Rawah Wilderness	Colorado	1970	James and Schreuder 1972	Total	89
5. Selway-Bitterroot Wilderness	Montana	1974	Lucas 1975	Day-use	19
				Campers	49
				Hikers	31
				Horsemen	11
				Total	28
6. Idaho Primitive Area	Idaho	1974	Personal Communication Earl Dodds, District Ranger	Total	18
7. Sawtooth Wilderness	Idaho	1975	Mullins 1975[1]	Day-hikers	85
				Camping hikers	87
				All horsemen	33
				Total	78
8. Waterton Lakes National Park	Alberta	1976	Scotter and Bernard[2]	Total	78
9. Spanish Peaks	Montana	1977	Lucas (unpubl.)	Day-hikers	40
(Spanish Creek, August only)				Day horsemen	0
				Camping hikers	78
				Camping horsemen	50
				Total	50

[1]Unpublished report by William H. Mullins, 1975, Sawtooth Wilderness visitors study. 18 p. USDA For. Serv., Sawtooth National Recreation Area, Ketchum Idaho.

[2]Unpublished report by George W Scotter and Joan L. Bernard, no date, Compliance rate at unmanned trail registers, Waterton Lakes National Park, Alberta Canada. 9 p. Canadian Wildlife Service, Edmonton, Alberta.

Trail registration rates appear highly variable, but lower in more recent observations than earlier cases, with the notable exception of the Sawtooth Wilderness. The studies show relatively poor registration by horsemen everywhere and to a lesser extent, by day-users. Day-users in the Sawtooth Wilderness, however, had an 85 percent compliance rate!

The 1977 pilot test data from Spanish Creek are difficult to compare directly to self-issued permits, because the trail register, which was checked only in August, was located about 500 yards up the trail, whereas the permit-issuing facility was located near the parking area. However, in general, it appears that self-issued permit compliance was substantially higher than voluntary registration by horsemen, about the same for backpack campers, and a little lower for day-hikers. From a management perspective, the data from the permits seem superior.

Self-Issued Permits Compared to Agency-Issued Permits

Published compliance data for agency-issued permits are available for just a few areas. In the Desolation Wilderness, California, where about 99 percent of the use is by hikers, in 1974 (the fourth year permits were required) about 40 percent of the day-users had permits, (Schechter and Lucas 1978) compared to 51 percent of the day-use hikers in the Spanish Peaks. About 85 percent of backpack campers in the Desolation Wilderness obtained permits from the agency offices, compared to 72 percent in the Spanish Peaks. Thus, the self-issued system in its first year worked a little better for day-users and a little worse for campers than a well-established agency-issued permit. If, however, only the compliance rate for campers at up-trail locations is considered, the Spanish Peaks compliance rate rises to 80 percent, not appreciably different.

The Boundary Waters Canoe Area, Minnesota, in 1971 (the sixth year of the permit system), had 88 percent compliance overall (Lime and Lorence 1974). The rate for day-users was 73 percent; for campers, 92 percent; both better than achieved in the Spanish Peaks. High compliance was attributed to enforcement, with citations and fines for noncompliance, 10 offices issuing permits, and about 100 local merchants (mostly resorts, sporting goods stores, and boat and canoe rental businesses) authorized to issue permits.

In the Great Gulf Wilderness, New Hampshire, in the summer of 1976 (the second year permits were required), 78 percent of all visitors were estimated to have obtained permits (Leonard and others 1978). Compliance by day-users was reported to be about 60 percent, and camper compliance 80 to 90 percent. Visitors were all hikers, so the figures compare to about 51 percent compliance for day-users in the Spanish Peaks and 72 percent for campers (or 80 percent for the superior up-trail locations). These small differences might be the result of the newness of the self-issued permit system in Montana.

The compliance rate in the Dry River Wilderness, also in New Hampshire, in 1975, the first year for permits, was 69 percent.[4] Again, all use was hiking, but no breakdown between day-users and campers was provided. These rates seem little different than the Spanish Peaks figures for hikers.

Compliance with agency-issued permits in the Three Sisters and Mount Jefferson Wildernesses, Oregon, were estimated at only 50 to 70 percent compliance (personal communication, S. Hanna), probably a little lower than the Spanish Peaks self-issued permits. On the other hand, the Glacier Peak and Pasayten Wildernesses in Washington and the Eagle Cap in Oregon estimate about 90 percent visitor compliance with agency-issued permits (personal communication, Bernard Smith).

The Spanish Peaks System Compared to Other Self-Issued Permit Systems

The Three Sisters and Mount Jefferson Wildernesses reported better than 90 percent compliance when they switched to self-issued permits. These compliance rates, of course, exceed those in the Spanish Peaks. Perhaps the earlier agency-issued permit set the stage for excellent acceptance of the more convenient self-issued permits. Most use was by hikers, probably contributing to high compliance rates. Also, permits were required at most wildernesses in the region, unlike the Spanish Peaks, which was the only National Forest area in the northern Rockies requiring permits.

Overall Evaluation

The self-issued, mandatory permit appears to have promise as a use-measurement system, recognizing that any system has other objectives, as well as costs. In its first year, it provided more complete data on some important types of users than trail registers, especially horsemen and fall visitors. During the second year (1979), compliance increased to about 90 percent at all locations except Spanish Creek, according to compliance checks by wilderness rangers (personal communication, John Dolan). It appears to be almost as complete in coverage as an agency-issued permit, and, if the Oregon reports are valid and reflect the general potential of the self-issued permit system, it can provide even more complete coverage.

A mandatory registration system has never been tested, so no comparison can be made. However, a special registration station that explained a research study was in progress and provided a justification or rationale for registering obtained excellent response rates. About 94 percent of all hikers and 67 percent of all horsemen registered (Lucas 1980). High compliance rates for voluntary trail registers reported by the Sawtooth Wilderness suggest that system may have the potential to perform better than it has in most places.

[4]Unpublished report by the Northeastern Forest Experiment Station, no author, no date, Travel permit compliance in eastern wilderness: some preliminary results. On file at the Forestry Sciences Laboratory, Durham, N.H.

Factors Affecting Compliance

Permit compliance is associated most strongly with visitors' length of stay. This was also true in Michigan (Leatherberry and Lime 1980). This had more effect on compliance than method of travel, which was only influential for day-users.

Summer and fall rates were essentially the same, unlike the case for trail registers, which have shown lower rates in the fall.

Lone visitors complied relatively poorly, as they also have done at voluntary trail registers (Wenger and Gregersen 1964; Lucas, and others 1971). This may be partly because of the brief stay of many lone visitors. One would think a person camping alone might have more motivation to register or obtain a permit to leave a record of his or her presence for security.

Locations away from the parking area, up the trail some distance, produced higher compliance rates by hikers, and at least as high compliance by horsemen. (This was also reported for the Sawtooth Wilderness). Day-use horsemen appeared to comply slightly better at up-trail locations, which seems somewhat surprising. One might expect better compliance at the parking area, where someone is usually ready before the others in the party and could easily register or write a permit while waiting, and it was not necessary to dismount to fill out a permit. However, actual visitor behavior did not bear this out. Several possible reasons can be suggested.

1. Signboards at the edge of parking lot may be lost in the clutter and confusion of cars and other signs. In contrast a sign up the trail stands out. (This reason also was cited for the Sawtooth Wilderness.)

2. Many groups have a leader recognized as the one to deal with registration or permit issuance. This person is unlikely to have free time at the parking area. He or she is overseeing preparations, checking equipment, and often distracted. After the party is on the trail, it may be much easier for the leader to focus attention on a sign and permit-issuing facility.

3. At the parking area people are anxious to start. After a little travel, and especially after climbing a hill, an excuse for a rest at a sign and permit station could be welcome, especially for hikers. Horsemen often find that saddles need adjusting after a short ride, making a stop necessary.

4. The up-trail location screens out some people making very brief visits, who rarely comply with the permit requirement. In a sense, this is more an apparent advantage than real, affecting the compliance **rate** rather than data on actual use.

5. An up-trail location can symbolize wilderness entry, and suggest an appropriate signing-in ceremony. By analogy, probably very few people fail to sign a mountain climbing register. For example, the most successful permit station in the Spanish Peaks, on the Deer Creek trail, was located furthest up the trail and right at the Primitive Area boundary.

MANAGEMENT IMPLICATIONS

Adoption of a Self-Issued Permit System

A self-issued permit system can be a useful wilderness management tool if managers are committed to the effort required to make it function effectively. Commitment by managers is probably the most critical factor in the success of either a permit or trail register system.

Adoption of a self-issued permit system must be based on objectives for each area and the estimated cost of a self-issued permit or alternative system. Use measurement is an important goal, but although it is the sole objective emphasized in this study, it is not the only one. Visitor contact and communications also are important, and these may involve receptionists in offices or visitor information centers, signs, brochures, and wilderness rangers. The role of each of these may vary depending on the type of permit or trail register system that is used.

As a use measurement system alone, self-issued permits have good potential. Rates of compliance compare well with alternatives, and provide more complete data on some types of visitors than trail registers provide. The system is probably less costly than agency-issued permits, and more convenient for visitors. Self-issued permits should cost about the same as trail registers, assuming both are well-maintained and serviced regularly at intervals appropriate for use levels.

The alternative of mandatory registration deserves consideration, unless the survey approval policy of the Office of Management and Budget is an insurmountable barrier. Where data collection, not use regulation, is the objective, the term "permit" might be considered by some to be a misnomer. It is possible (no data are available) that some visitors are irritated by the tone of Government control they perceive in permit systems and that they do not comply as a form of protest. If a mandatory registration system had a copy of the registration form to be carried by the visitor for compliance checking by wilderness rangers--and this would seem necessary--the distinction becomes purely one of name, and visitor reaction is difficult to predict.

Station Location

Locations up the trail are clearly superior to end of road, trailhead parking areas in obtaining visitor compliance; however, the added time and cost required to build such stations and to service and maintain them is a disadvantage. For example, a station 1 mile up the trail might require an extra 40 minutes to an hour each time it was checked. We experienced little vandalism in the Spanish Peaks, but what little occurred was unrelated to up-trail or trailhead location. Although not tested formally in the study, location very close to the edge of the trail (as at Cascade Creek, Deer Creek, and Little Hellroaring Creek) and in the line of sight of the trail, which curves around the station (as at Deer Creek), seems desirable.

In areas with appreciable horse use, the station location should provide room for stock and include a hitching rail. The permit station should be designed to invite a stop to adjust cinches, stirrups, or packhorse loads. A sign near the trailhead could inform visitors, especially horsemen, of the distance to the station and point out that it is a good place to check saddles and other tack, somewhat like a highway sign, "rest area ahead."

Station Design

The station design tested included a map, both as a service and as an attractor, and consolidated all information in one place. Permit boxes were a conspicuous bright blue.

No design alternatives were tested, but bright colors and eye-catching design probably are helpful in influencing visitors to stop and leading them to filling out a permit. Red or orange permit boxes might have been more effective. Backpackers sometimes trudge along, eyes fixed a yard ahead of their feet, and both color and placement need to be designed to make the station impossible to pass by unnoticed.

Station Maintenance

The permit stations in the Spanish Peaks were visited frequently and kept well supplied with forms and pencils. Busy locations were usually visited every other day and even the most lightly used stations at least once a week.

Frequent maintenance is essential. No data can be obtained if a station runs out of forms, and the lack of pens or pencils will deter many visitors. The inability to obtain a required permit puts conscientious visitors in an awkward position. Do the visitors leave without a permit, or take the time to try to get one elsewhere? A poorly maintained station tells the visitor that the permit requirement (or registration) is not important to the agency.

The effect of vandalism can also be limited by frequent servicing. All permit forms, blank and completed (completed forms were exposed in the design used) were stolen from the Spanish Creek station about July 15. Only 2 days' worth of completed forms were lost. With infrequent maintenance this interruption would have been much more serious. Managers, although discouraged, should not use vandalism as an excuse to do nothing. Unfortunately, vandalism is a cost of doing business.

Monitoring Compliance

If a self-issued system is used, periodic monitoring of visitor compliance is essential. Monitoring should encourage better compliance over time. Fairness to those visitors who make the effort to comply would seem to require an enforcement effort. Monitoring is also necessary to check compliance rates, which must be estimated with reasonable accuracy to convert permit data into acceptable use measurements, and which can shift with time. This study suggests recording compliance based on length of stay, and at least for day-users, on method of travel.

Based on results, to estimate total actual use, permit data for the Spanish Peaks would be multiplied by about 1.4 for campers, by about 2.0 for day-hikers, and by about 4.0 for horseback day-visitors. Until more experience accumulates, the possibility of summer-fall differences needs to be checked, as well as possible differences in compliance between campers who hike and those who use horses.

The most efficient way to monitor compliance is to have wilderness rangers keep careful records of their compliance checks, and tabulate and analyze these records each winter, after the main use season. Wilderness rangers will tend to contact a larger proportion of visitors who penetrate the area than of the visitors who only travel in the periphery--especially, the brief, day-users. This will probably cause the rangers' compliance checks to overstate compliance for day-users. This may not be critical, but some trailhead checking could provide data for adjusting this compliance estimate if desired. The traffic counter-camera system is effective for monitoring use if carefully installed and well-maintained. It is an effective tool for accurate use measurement and classification.

Data Editing

Prompt editing, especially by people familiar with the area and its use, has numerous advantages. Incomplete or obviously inaccurate data can sometimes be corrected without resorting to guessing. Keeping reasonably current on editing and coding avoids an overwhelming job with insufficient time at the end of the season, just before the report is due.

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APPENDIX I

PERMIT FORM USED IN THE SPANISH PEAKS PRIMITIVE AREA

U.S. Department of Agriculture
U. S. Forest Service

Self-Issuing
WILDERNESS PERMIT

Name _____

Address _____

City _____ State _____ Zip _____

To visit _____
(NAME OF WILDERNESS)

Give best estimate of start and finish dates — FROM MO./DAY _____ THROUGH MO./DAY _____

Location of entry _____

Location of exit _____

Primary method of travel _____

Number of people in group _____

Number of pack or saddle stock _____

Number of watercraft or other craft _____

LIST PLANNED CAMP AREAS

	DATE			DATE	

(PLEASE DO NOT WRITE IN CROSS-HATCHED SPACE)

I agree to abide by all laws, rules, and regulations which apply to this area, I will do my best to see that everyone in my group does likewise.

_____ (DATE) _____ (SIGNATURE)

Remarks _____

U.S. Department of Agriculture, Forest Service

Keep the white copy in your possession while in the wilderness.
Please place yellow copy in nearby receptacle.

APPENDIX II

FORMS USED FOR CLASSIFICATION OF TRAFFIC AND COMPLIANCE

SPANISH PEAKS USE DATA, 1978

Trailhead Spanish Cr. (code in col. 6) Classification At trailhead.
Dates and approximate times covered from 8/17, 10:30a to 8/24, 11:15a

	Col. 1		2		3			4	5			
	Season		Length of Stay		Method of Travel			Party-size	Permit Compliance			
	Summer	Fall	Day	Overnight	Hike	Hike w/stock	Horseback	No. of People	Yes	No	Uncertain	
	Code 1*	2	1	2	1	2	3	Code direct	1	2	3	
1	1			2	1			2	1			
2	1			2	1			3	1			
3	1		1				3	4		2		
4	1			2	1			2	1			
5	1		1		1			2	1			
6	1		1		1			2	1			
7	1		1		1			1	1			
8	1		1		1			5		2		
9	1		1		1			9		2		
10	1		1		1			2	1			
11	1			2	1			2	1			
12	1			2	1			1	1			8/20
13	1		1		1			1		2		
14	1		1		1			3	1			
15	1			2	1			2		2		8/21
16	1			2	1			1	1			
17	1			2	1			2	1			8/22
18	1		1		1			1		2		
19	1			2	1			1	1			
20	1		1		1			2	1			
21	1		1		1			1		2		
22	1		1		1			6		2		
23	1		1		1			2		2		
24	1		1		1			8	1			
25	1		1		1			1		2		

	Day-use	Overnight	Hiker	Hike/stock	Horseback	1 person	2-6	7+	Total
No. of parties‡	16	9	24		1	8	15	2	25
No. complied	7	8	15		0	4	10	1	15
% complied	44	89	63		0	50	67	50	60

* Put correct code number on line below
‡ Omit parties that could not be classified on permit compliance.

SPANISH PEAKS - 1978 - SELF-ISSUED PERMITS

LENGTH-OF-STAY FOR DAY-USERS

Trailhead Cascade Creek Date 7/27 – 8/3

Length of Visit	COMPLIANCE		
	Yes	No	Uncertain
≤ 1 hour (No dots)		𝍸	
≤ 2 hours (1 dot)	𝍸	𝍸	
≤ 3 hours (2 dots)	𝍸		
More than 2 dots	𝍸 𝍸 𝍸 𝍸		
Uncertain			

☆ U. S. GOVERNMENT PRINTING OFFICE: 1981—777-028/90 REGION NO. 8

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A self-issued, mandatory visitor permit system was evaluated as a use measurement system during its first year of operation in the Spanish Peaks Primitive Area, Montana. Overall, 53 percent of all visitor groups obtained permits. Length-of-stay was the factor most related to compliance. Overnight visitors (campers) complied well; day-visitors did not, especially those making brief visits. Self-issuing permit stations located up the trail performed better than those adjacent to parking areas. Self-issued permits appear to have advantages over voluntary trail registers for measuring use. Recommendations for raising compliance, which would also apply to trail registers, are presented.

KEYWORDS: wilderness, recreation, use measurements, permit systems, trail registers, Montana.

The Intermountain Station, headquartered in Ogden, Utah, is one of eight regional experiment stations charged with providing scientific knowledge to help resource managers meet human needs and protect forest and range ecosystems.

The Intermountain Station includes the States of Montana, Idaho, Utah, Nevada, and western Wyoming. About 231 million acres, or 85 percent, of the land area in the Station territory are classified as forest and rangeland. These lands include grasslands, deserts, shrublands, alpine areas, and well-stocked forests. They supply fiber for forest industries; minerals for energy and industrial development; and water for domestic and industrial consumption. They also provide recreation opportunities for millions of visitors each year.

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